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Comparative Analysis on Different Generations of Cryptocurrency

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ABSTRACT
Cryptocurrency is the new era of currency that has already at its apex and still going to achieve many things in the future. A cryptocurrency is a digital form of currency in which no centralized authority is there between transactions that is they are done peer to peer. The basic technology behind this is called blockchain which is discussed in detail in this paper. According to the timeline of inventions of different cryptos, they are differentiated into different generations like bitcoin which was the first-generation cryptocurrency after that in the second generation Ethereum came which is one step further of bitcoin and then current generation which is known as the third generation in which Cardano, Pollkadot, etc came under this. All these generations, their principal, applications, and comparative studies are included in this research paper.

Keywords: *Bitcoin, Blockchain, Cardano, Comparative Analysis, Cryptocurrency, Ethereum*

1. Introduction

The 20th century is shifting itself from almost all types of paradigms and becoming more and more digital, lots of new technology is taking place like cloud engineering for storage, artificial intelligence, machine learning, etc, and everything has become digitalized from buying a pencil to an automobile. Everything can come online and digitalized payments are also in the pipeline to make a stand for themselves in the market and in many parts of the world they had already been excepted and established. The basic technology behind almost all these tech currencies is known as a blockchain.

Blockchain, initially introduced as a Bitcoin Cryptocurrency by Satoshi Nakamoto, is today much more than that. It offers a trusted platform for the exchange of any service and transaction over a distributed network programmer and thus Bitcoin is the first-generation cryptocurrency.[1]

After Two years in 2011 Ethereum came into the market which was more of a platform to make Dapps i.e., decentralized apps as well as decentralized internet rather than solely a cryptocurrency. These new features made Ethereum come under the second generation.

In Later times various new cryptos are introduced which are somehow different from one another, but the new change that came was in third-generation crypto- currencies like Cardano which combined the features of both bitcoin and Ethereum or say polka-dot that

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could connect between different specialized blockchains into a single network. Till date there are more than 5000 cryptocurrencies are there in the market that can be traded [2].

2.What is Cryptocurrency

In simple words, if we define what cryptocurrency is, so it can be stated as a form of digital currency in which no centralized authority is involved which means the whole transaction took place directly between person to person. Crypto- currencies use cryptographic protocols or extremely complex code systems that encrypt sensitive data to secure their units of exchange. Cryptocurrency developers build these protocols on advanced mathematics and computer engineering principles that render them virtually impossible to break, and thus to duplicate or counterfeit the protected currencies. These protocols also mask the identities of cryptocurrency users, making transactions and fund flows difficult to attribute to specific individuals groups.[3] Some of the major cryptocurrencies which are still in use in the market are bitcoin,ethereum, Cardano, Polkadot, cosmos etc. and the list goes on. Cryptocurrencies can be seen as part of a broader class of financial assets, “crypto assets”. What distinguishes cryptocurrencies from other crypto assets? This depends on their purpose, i.e., whether they are issued only for transfer or whether they also fulfil other functions[4] .Mostly all the cryptocurrencies are fine in supply and that's what differentiates them from other fiat forms of currencies and even helps to prevent precious resources like gold, silver, etc. The fundamental technology on which almost all of the modern cryptos are based is known as Blockchain which was first used by Satoshi Nakamoto when he introduced bitcoin to the world and from that very day, the digital currencies which are used for trading nowadays use this masterpiece, not only as a stock trade but to make contracts and other trades as well. It could have an impact on the pledging of collateral, on the registration of shares, bonds and other assets, on the transfer of property tiles, on the operation of land registers,etc. [5]

3.Introduction to Blockchain

You may not be following the crypto space, which has been in existence for several years now, but most likely, you are beginning to see major corporations around the world show great interest in blockchain technology. Perhaps what significantly popularized blockchain technology is Bitcoin because blockchain is the record-keeping technology behind it. One common definition of blockchain that,we often see online, is that it is a distributed and decentralized public ledger [6]. But there is more depth in this basic definition, the blockchain is composed of two terms ‘block and ‘chains’ which means data is stored in form of blocks that are chained together. There are some key factors which are included in this, like every detail regarding the transaction details are including say the dollar amount, time of the transaction , details of the parties which were included in the transaction, but the real name isn’t used, instead a key (also known as a private key which is different for different user) is mentioned in the database. In a report published on January 3, 2018, Royal Bank of Canada (RBC) Capital Markets analyst Mitch Steves confidently stated that the cryptocurrencies and blockchain technology applications market could increase thirteen-fold in 15 years, reaching $10 trillion. [7]

The next major feature is distinguishing among several blockchains, like whenever we go to a restaurant a bill is provided to us, similarly here blockchain uses the “hash” technique to differentiate among other transactions. A hash is a cryptographic code that is created by special algorithms. Each block on the blockchain can store the details of more than one

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transaction. For instance, we can store about 1 MB of data in one block on the Bitcoin blockchain. What this means is that we can store a few thousand transactions in a single block – though this depends on the size of the transactions. Blockchain, with its diverse set of tools and interwoven communication and consensus requirements, allows blockchain-based applications and tools to work more readily with other existing systems in many cases [6,8]

4.Working of Blockchain:

The main feature that is involved in the blockchain is distributed database and each chain works with others in peer to peer(P2P) fashion.

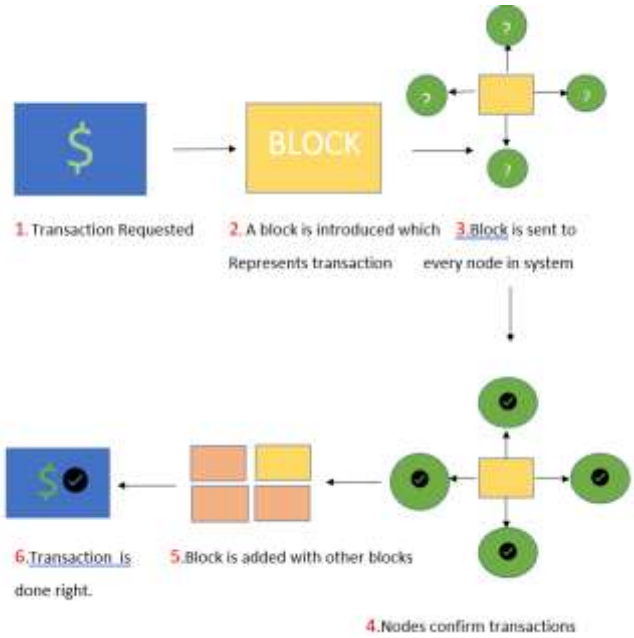

Figure 1. Transaction in a blockchain

Figure 1. shows Several nodes help to do the transactions in blockchain, it requires a network that resides on the internet. These nodes confirm the new block that should be added with blocks which are already present in the network and at last,after the validation by all the nodes transaction became successful. Furthermore, within the network, there are certain exchanges, for purposes of updates. These updates are required to continuously keep the distributed ledger system up to date with the latest block. In this way as shown in the Figure all those devices can communicate with each other using the internet and keep on updating each other. Because there is no master node or a centralized machine that has a different purpose than the rest of them, this network is called a peer-to-peer network.[9] In this way, there is no any centralized authority that is controlling the movement of data, and at last, the data is then hashed, verified, and mined in the blocks by a consensus mechanism.

5.Applications of Blockchain:

Blockchain technology is increasing with rapid growth and hence there are several applications of blockchain, in the field of business, trading, etc. Some of the applications are listed below.

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(i)Accounting settlement and crowdfunding

Bitcoin or another virtual currency supported by blockchain technology can help businesses to solve funding-related problems. For instance, cryptocurrencies support companies that wish to implement non-cash payments and accounting settlements. The automation of electronic transaction management accounting improves the level of control of monetary business execution, both internally and externally [10]. Beside this, it is also used in crowdfunding as now they can trade in digital coins and there is no need for traders or contractors to carry cash or checks with themselves.

(ii)Decentralization of data storage

Decentralized data storage means we don't have to give data to any centralized source instead it is available for people and hence no one can temper it because the same block is stored in thousands of computers all over the world. Hence if a hacker tempered with a code in one computer, he had to make changes in all the computers which is not possible and that's why it makes the data more secure. Thus, businesses can also use this to be more transparent with their clients and be protected from scammers at the same time. In this way the blockchain can be used for all type of business in a decentralised mode.

(iii) Supply Chain Management

After the coming of blockchain, the supply chain management has changed drastically as blockchain is further backed by other technologies like Internet Of Things (IoT), Cloud engineering, etc. Blockchain Technology provides four key features that can enhance integration and coordination among the members of an supply chain (1) transparency, (2) validation, (3) automation, and (4) tokenization[11] which helps to do take the relation of customer, and buyer on a global level and now both can store every information regarding the product or the bills or the transactions everything in the blockchain which helps one individual to increase its own business on a new level.

6.Generations of Cryptocurrency

It is already mentioned above that bitcoin was the first coin that has been widely accepted all over the world, but soon after the invention of bitcoin, various other tech currencies started to come into the market following the same fundamental technology i.e. blockchain, but they are still filling up some voids or say one way or another is different from bitcoin, for example after the invention of bitcoin in 2009, in 2011 Ethereum came into the market which also gained major popularity in just a few months even though it was not whole of a cryptocurrency but still, and by the year 2015 there were around more than 600 currencies which are competing against each other in the market. Thus, for a proper categorization according to their timelines when they are being invented, different generations were decided. Bitcoin was the first-generation cryptocurrency followed by Ethereum in 2011 came under second-generation currencies and the third generation like Cosmos, IOTA, Polkadot, etc came under this and there will be going to many more generations which are still going to come in future with more and more enhanced versions of themselves and with many new features as well. For obtaining the current price of today's cryptocurrencies from yahoo finance, the results show that the optimal portfolio using Markowitz approach consists of Cardano, Binance Coin, and Bitcoin.[12]

A brief analysis of major generation along with case studies are explain below.

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6.1 First Generation -Bitcoin

Bitcoin is an online communication protocol that facilitates the use of a virtual currency, including electronic payments. Since its inception in 2009 by an anonymous group of developers (Nakamoto 2008), Bitcoin has served approximately 62.5 million transactions between 109 million accounts. As of March 2015, the daily transaction volume was approximately 200,000 bitcoins—roughly $50 million at market exchange rates—and the total market value of all bitcoins in circulation was $3.5 billion Also bitcoin index value amounted to 3,689.56 U.S. dollars and there was 4036 Bitcoin ATM worldwide at the end of December 2018 [13,14], Bitcoin's rules were designed by engineers with no apparent influence from lawyers or regulators. Rather than store transactions on any single server or set of servers, bitcoin is built on a transaction log that is distributed across a network of participating computers [15]. No one has ever thought that bitcoin would become this popular that even the government of every country want to participate themselves in this and make it more authentic and official.

For the first rudimentary years bitcoin didn't have any value instead they were on trial stage and it was Nakamoto only who is finalizing the code and at last in 2009 he declared the bitcoin as an open-source. Nakamato didn't make the bitcoin from scratch instead he mixed the ideas of the things that his predecessors had never done. After few years Satoshi completely distanced himself from bitcoin it is claimed that Satoshi is the largest holder of bitcoins with about 1000000 BTC.

Another interesting thing about bitcoin which differentiate itself from other form of currencies is that they are produced in a finite amount which is 21 million bitcoins ,around 50 bitcoins are produced in every 10 minutes and same process is going on since 2012 but later production rate was set to half that is 25 bitcoins in every 10 minutes in 2016,12.5 till 2020 and will be 6.5 until 2024.In this way it is expected that all 21 million bitcoins will be produced by the year 2140.The next trait of bitcoin which is highly rated is its divisibility, it can be divided up to eight decimal points which is quite robust, the smallest point is 0.00000001 knows as "Satoshi". In the Figure No.2 it can be seen how volatile the price has been for bitcoin so far.

The key features of bitcoins are:

Irreversibility of Transactions: Once the payment is made not even Satoshi himself can reverse it, neither any powerful authority and hence it should be done carefully.

Pseudonymous: The other party could never see your real name or and vice versa as instead of names, wallet address is being used which does not carry any personal information.

Safe and secure: All coins are mined through cryptography and thus every individual has its own private key which cannot be accessed by a third party.

Robust in nature: The transactions are done within few minutes to any part of the world with P2P network and thus its quite powerful in nature.

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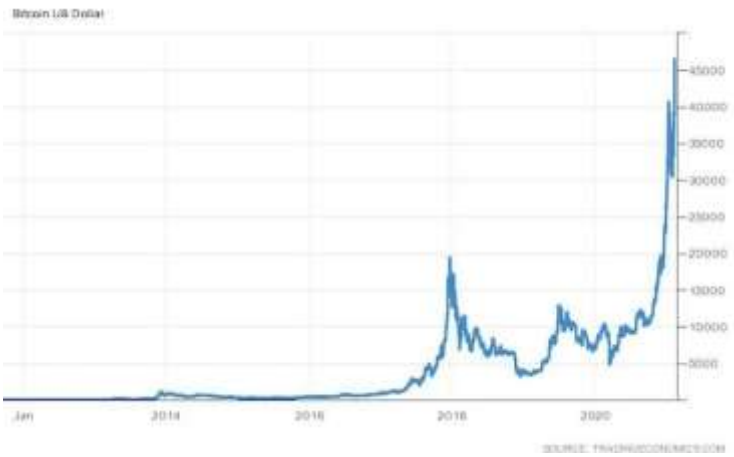

Figure 2 Volatility of the price for bitcoin (Source: TradingEconomy.com, assessed on 26th April 2021)

Case Study: JP Morgan Acceptancy of Cryptocurrency

There are lots of billionaires who either accepted the bitcoin or rejected it and some are just on the fence and who are still learning about the pros and cons of it. Some of them who takes positive aspects of bitcoin and enhance. It is Elon musk who highly appreciated the digital currencies and even supported doge coins whose price got increased very next day because of just one tweet, the one who rejected this concept is bill gates who don't see future in the bitcoins and didn't consider it as reliable as the fiat dollars are.

One of such renowned owner who publicly bashed the bitcoin, the CEO of JP Morgan Jamie Demon, in one of his statement he said that he considers bitcoin as of the largest fraud in the world and told that they would "pay the price for it one day. During "Delivery Alph" conference he laughed while saying "My daughter bought some bitcoin, and it went up and she thinks she's a genius now." and often mentioned bitcoin as "stupid". He eventually added that he would fire any employee of the bank who was caught trading bitcoin [16]. Thus, it mentions the emotions of Damon regarding bitcoin.

Interestingly, after few months their own bank has launched their own cryptocurrency called JPM coin and thus he later backtracked stating that he was always optimistic about Bitcoins underlying technology and is in full favour as well as open-minded about cryptocurrencies as long as they are well regulated and controlled and now even taken his statement back. It may be because he may have meetings with the key players of his management who may know what potential cryptocurrencies and bitcoin has. The coin is fixed with a price of a dollar and designed in such a way that they won't be volatile in nature i.e., they will be considered it as a stable coin.

Later J.P. Morgan became the first U.S. bank to create and successfully test a digital coin representing a fiat currency. The JPM Coin is based on blockchain-based technology enabling the instantaneous transfer of payments between institutional clients.

6.2 Second Generation-Ethereum

After bitcoin became successful, around two to three years later Ethereum came to the market which was made by Vitalik Buterin.The fundamental basis for creating Ethereum was to create an alternate platform for makingdApps (decentralized apps) ,just like bitcoin they also didn't have any centralized authority and thus it was easy for individuals who want to show their apps to world but couldn't because of various strict policies offered by different platforms whereas in Ethereum it was opensource and mainly they were more

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development oriented rather than going for cryptocurrency domain, they also had used the same technology which same as blockchain .That's why Ethereum can be categorized in second generation as they were not focussing on one domain but one step ahead in digitalisation.

There is often comparison between bitcoin and Ethereum, but it needs to be understood that they are two very different things, bitcoin was only for payment purpose on the other hand Ethereum has their own payment system, internet browser and the most important feature that is to provide necessary resources for developers to help them in making and deploying decentralised apps which will automatically help in creating new ideas. Ethereum represents a blockchain with a built-in Turing complete programming language. It provides an abstract layer enabling anyone to create their own rules for ownership, formats of transactions, and state transition functions. This is done by involving smart contracts, a set of cryptographic rules that are executed only if certain conditions are met.[17]

There are so many files and humungous amount of data which is available on the internet but one way or other everything is in watch of either the apps where we had saved them for temporary purpose or may be in some cases the government as well but in case of Ethereum no third party is there who can watch over your data and neither one could delete it because it is stored in thousands of node and the most important thing that changed the Ethereum was introducing smart contracts among the parties who are involved in any kind of trading.

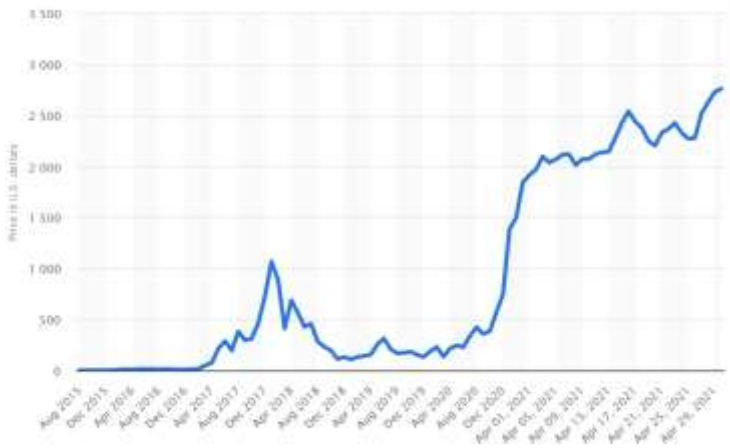

Figure 3- Volatility of Ethereum for Last Five Years. (Source: Coindesk.com, assessed on 29th April 2021)

Figure 3 shows that how volatile Ethereum had been from its past and will even fluctuate in the future as well.

Additionally, Ethereum is introduces a feature named Smart Contracts. The basic concept behind smart contracts is to translating contractual clauses (collateral, bonding, etc.) into code, and embedding them into the property (hardware, or software) that can self-enforce them , to minimize the need for trusted intermediaries between transacting parties, and the occurrence of malicious or accidental exceptions SCs are generally developed in a programming language known as Solidity, Go, Kotlin/Java, or C++' over various BC platforms like Ethereum, TRON, Stellar, and Hyperledger. These platforms ensure the data to be protected from Cybersecurity attacks (such as modification, spoofing, and fabrication attacks) and real-time settlement of digital payment [18,19**]**. As they run on a blockchain, they follow the peculiar path for what they are programmed to, and thus the possibility of fraud, downtime is next to nil.

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Case Study: Implementation of ZUG Digital ID

The United Nations predicts that by 2050, 68% of people will live in urban areas. This mass influx of citizens will place stress on current governmental systems and processes. To ensure cities are well equipped to deal with the myriad of upcoming challenges, an increasing number of cities are making the steps towards becoming "smart" cities.
Zug, aka Crypto Valley, set out to explore blockchain-based digital identities to improve access to digital government services while increasing efficiency, data security, and voting accessibility [20]
There are around 4 times elections held in the year regarding different issues like smoking, climate change, etc and elections are done via ballot paper. Zug leveraged uPort, a blockchain technology is used to create a decentralized platform which was the world's first live implementation of a self-sovereign government-issued project based on Ethereum blockchain, and the help of another platform like Luxoft to implement voting. In 2017 Zug launched a program for the registration of resident IDs on the public Ethereum blockchain. Zug created their identity platform for the public and gives them the authority to sign in and verify data. This made a drastic change and even it was easy to operate as it is already available on Apple Store and it uses a private key which is unique for every user that acts as the user's identity agent. Citizens visited the Zugs website for registration by scanning QR code, all they had to do is to enter the date of birth and passport number and within 14 days an in-person verification will be done via an agency and after confirmation, they all can access several services provide by uPort App.
This is how one agency understood the potential of Ethereum and implemented it for others' welfare and even their identity will be secured and thus there will be no malpractice during the times of elections as well.

6.3 Third Generation-Carando

The third generation was one step further by leveraging the successes that the previous generation has achieved, like Cardano, cosmos, IOTA. They were more focused on scalability that more inclined to the built base platform, the third generation is also focusing on cross-chain transactions or interoperability. Smart contracts of the third generation are also become more robust and powerful to guarantee a perfect software, plus the core systems are fully backed by government and compliance as well.
Cardano is a promising cryptocurrency that seeks to improve all the problems with Ethereum. What makes Cardano different from other cryptocurrencies is the level of technical competency in this new blockchain technology. Even the most successful cryptocurrencies right now are not able to handle the level of transactions that are done through Visa and MasterCard, but ADA coin is getting close to handling thousands of transactions per second. Bitcoin and Ethereum cannot even get a fraction of that but Cardano can.
Thus, it can be said that it will be the new revolution in the era of cryptocurrencies. Even some of the most successful traders rely on Cardano. Currently, ADA is ranked as the 8th biggest cryptocurrency based on capital worth $0.16.[21] Figure 4 shows that it will be the new feature and may be one of the most crypto with so much potential and their aim

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is also to maintain Cardano ADA as a stable coin rather than being so much volatile in nature.

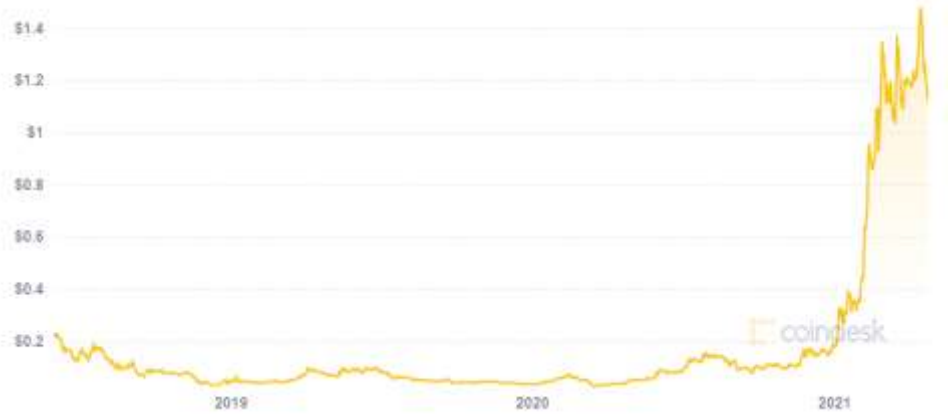

Figure 4 - Behaviour of Cardano ADA (Source: Coindesk.com ,assessed on 3rd May2021)

7. Criteria Wise Comparison of All Three Generation of Cryptocurrency

After going through detailed study of all three generations of Cryptocurrency a criteria wise comparative study is shown in Table No.1 comprising of different features of generations of Cryptocurrency**.** This comparative chart will help the user to select a particular generation according to need.

Table 1. Criteria wise comparison of Three Generation of Cryptocurrency

Criteria	First Generation (Bitcoin)	Second Generation (Ethereum)	Third Generation (Carando)
Timeline	2009	2013	2017
Technology Used	Blockchain	Blockchain	Some like IOTA uses acyclic graphs
Transaction speed	Slower as compared with other two generations	Faster than the 1st generation	Fastest
Smart Contracts	Not introduced	Introduced	Introduced
Cross chain transactions	Cannot be done	Cannot be done	Can be done
Development Complexity	Fixes and updates are hard to implement	Fixes and updates are hard to implement	Can be upgraded easily with emphasis on verification
Market Position	Very Strong as first one in the market	Strong as came after quite 1st.	People are still recognising them.

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Block time	8-10 minutes	12-15 sec	15-20 sec.
Transaction fees	None	1-4	None
Proof of stake	Low	Moderate	High

8. Conclusion

The present paper does a comparative analysis of different generations of cryptocurrency on the basis of their main features. From the above study, it can be seen that neither the cryptocurrency nor the blockchain will be declining anytime soon and in the future, they will reach their pinnacle with even more sophisticated technology even the fourth generations are also in the pipeline and maybe in the future the whole world would count on the blockchain or even the only form of currency will be digital coins, but these things will take time and more funding as well as brains. The paper will be useful for a common man to understand the basic concept of cryptocurrency & its application which will be useful in implementation as per the requirement.

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